

The Globalization of America's Defense Industries

Theodore H. Moran

Managing the Threat of Foreign Dependence

Soviet and American forces leave the heart of Europe.⁸¹ It will be a force for trouble unless it is curbed. The teaching of honest national history is especially important, since the teaching of false chauvinist history is the main vehicle for spreading virulent nationalism. States that teach a dishonestly self-exculpating or self-glorifying history should be publicly criticized and sanctioned.⁸²

On this count it is especially important that relations between Germany and its neighbors be handled carefully. Many Germans rightly feel that Germany has behaved very responsibly for 45 years, and has made an honest effort to remember and make amends for an ugly period of its past. Therefore, Germans quickly tire of lectures from foreigners demanding that they apologize once again for crimes committed before most of the current German population was born. On the other hand, peoples who have suffered at the hands of the Germans cannot forget their enormous suffering, and inevitably ask for repeated assurance that the past will not be repeated. This dialogue has the potential to spiral into mutual recriminations that could spark a renewed sense of persecution among Germans, and with it, a rebirth of German-nationalism. It is therefore incumbent on all parties in this discourse to proceed with understanding and respect for one another's feelings and experience. Specifically, others should not ask today's Germans to apologize for crimes they did not commit, but Germans must understand that others' ceaseless demands for reassurance have a legitimate basis in history, and should view these demands with patience and understanding.

None of these tasks will be easy to accomplish. In fact, I expect that the bulk of my prescriptions will not be followed; most run contrary to powerful strains of domestic American and European opinion, and to the basic nature of state behavior. Moreover, even if they are followed, this will not guarantee the peace in Europe. If the Cold War is truly behind us, the stability of the past 45 years is not likely to be seen again in the coming decades.

81. On the evolution of nationalistic history-teaching in Europe see Kennedy, "The Decline of Nationalistic History," and Dance, *History the Betrayer*.

82. My thinking on this matter has been influenced by conversations with Stephen Van Evera.

American defense industries, like the rest of the American economy, are undergoing a process of globalization. The Defense Science Board, the undersecretary of defense for acquisition, the Office of Technology Assessment, and a variety of congressional committees join in warning that U.S. defense increasingly relies on foreign technologies, foreign-sourced products, or domestic-sourced products purchased from the local subsidiaries of foreign corporations.¹ When should this trend toward globalization be worrisome, when should it be embraced, and when can it be ignored?

The dialogue between economists and national security analysts on these questions has tended to be limited, unproductive, and highly unsatisfactory to both sides. With the exception of industrial policy advocates and strategic trade theorists, discussed below, economists ordinarily ignore the nationality of producers, and scoff at ideas that governments should preserve certain companies, simply on the basis of the citizenship of their owners or managers or workers, if those owners or managers or workers are unable to compete as cheaply or imaginatively as others can. When defense analysts recommend

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1. U.S. Department of Defense (DoD), *Bolstering Defense Industrial Competitiveness: Preserving Our Heritage, Securing Our Future*, Report to the Secretary of Defense by the Undersecretary of Defense (Acquisition), July 1988; Defense Science Board, *The Defense Industrial and Technology Base*, Final Report of the Defense Science Board 1988 Summer Study, October 1988; DoD, *Critical Technologies Plan*, for the Committees on Armed Services, United States Congress, May 5, 1989; U.S. Congress, Office of Technology Assessment (OTA), *The Defense Technology Base: Introduction and Overview—A Special Report*, OTA-ISC-374 (Washington, D.C.: U.S. Government Printing Office [U.S. GPO], March 1988); and OTA, *Holding The Edge: Maintaining the Defense Technology Base*, OTA-ISC-420 (Washington, D.C.: U.S. GPO, April 1989). Cf. also Senator Jeff Bingaman and Senator John McCain, *Deterrence in Decay: The Future of the U.S. Defense Industrial Base* (Washington, D.C.: The Center for Strategic and International Studies, 1989).

that the United States "stop the loss of production capabilities," "reverse the trend" toward globalization, and "secure" the industrial base, economists instinctively identify their pleas (except for the narrowest categories of finished military equipment like tanks and guns) as nothing more than new instances of old attempts at protectionism and the preservation of inefficiency.

To national security analysts, on the other hand, *where* production takes place and *who* controls the process are of crucial importance. The benign neglect by conventional economics of the nationality of economic actors seems singularly unhelpful in analyzing what to do about the defense industrial base. Quite apart from traditional preoccupations with the blockage of sea lanes in time of war, the contemporary movement toward globalization opens the door in peacetime to foreign influence, foreign control, and foreign domination. For this reason national security analysts show little patience with the economists' obsession about efficiency and consumer welfare if, in the process, the United States becomes "dependent on foreign-sourced hardware" or, via foreign acquisition of domestic facilities, increasingly reliant "on technologies controlled by other nations."² What is for economists the unfolding of international comparative advantage is, for national security analysts, an erosion of the "capacity to build or replace critical force structures independently of economic and political decisions of other sovereign powers."³

How can a dialogue between economists and national security analysts be structured to find ways to maximize efficiency and at the same time to minimize foreign control? How would a new generation of strategists, *defense industrial strategists*, trained in both economics and defense analysis, approach the problem of globalization?

The prospect of launching a productive dialogue between economists and national security analysts faces high hurdles in the United States. The American encounter with globalization is relatively new and particularly upsetting. The discussion of policy options cannot avoid plunging into sensitive issues with high ideological and doctrinal content: Should a country insist on relying on its "own" firms, or insist on having production take place on its own soil (neo-mercantilism versus liberalism)? Does a country need an "industrial policy" that promotes specific sectors with public monies (government inter-

vention versus market allocation)? What policies should a country adopt when a sector crucial for defense might be "wiped out" (free trade versus protectionism)?

But a productive dialogue is necessary and feasible, as I explain in this article. The first section begins with the neo-mercantilist critique of the non-chalance of conventional economics toward both the nationality of companies upon which the defense effort rests, and the sovereign jurisdiction over the soil where key research or production activities are carried out. This critique is as alive in the contemporary reports of the Defense Science Board or the Congressional Office of Technology Assessment as it was in the ministerial convocations of Charles de Gaulle. The first section also examines the subtleties of European countries' recent experience with creating their own companies and insisting on local research and production sites, to find lessons for the United States.

The second section moves to questions of industrial policy, promotion of new technology, strategic trade, and protection of defense-related industries in the United States. It urges a broad definition of what constitutes the defense industrial base and a narrow, easily operationalizable test to determine which sectors and subsectors qualify for special policy attention.

The two sections build on each other with an unexpected synergism: in the third, I argue that wrestling with the dilemmas of neo-mercantilism, frustrating though the process has been for the Europeans and will doubtless be for the United States, forces one to define exactly what is the nature of the peacetime threat from globalization, and to confront exactly what does, and what does not, help to meet that threat. The results make the most difficult U.S. policy questions much easier to sort out.

"The Threat" of Globalization: Europe and the Dilemmas of Neo-Mercantilism

Every current study of the U.S. defense industrial base warns that the lack of attention by liberal economics to the security dimensions of globalization is unacceptable, but the examination of alternatives within the context of the American experience is, of necessity, sketchy and incomplete. Cases and examples from Europe, however, enable a much richer and more profound probing of alternatives. In the past three decades alone, European governments of diverse ideologies, acting on neo-mercantilist impulses, have tried out all the major policy options now being proposed for the United States.

2. DoD, *Bolstering Defense Industrial Competitiveness*, pp. 27-29.

3. *Ibid.*, p. 2; Defense Science Board, *The Defense Industrial and Technology Base*, chap. V.

What lessons does the European experience have to offer the United States? Four hypotheses comprise the heart of the neo-mercantilist approach.

HYPOTHESIS I: LIBERAL AGNOSTICISM TOWARD THE NATIONALITY OF COMPANIES AND THE LOCATION OF CRUCIAL RESEARCH AND PRODUCTION ACTIVITIES POSES UNACCEPTABLE RISKS

To say that the European experience can help "test" this hypothesis would not, strictly speaking, be accurate. On the one hand, the overwhelming number of transactions involving trade, investment, or the licensing of technology with foreign companies will suggest that such dependence constitutes no threat. On the other hand, the one exception, if serious enough, will confirm that liberal tolerance is foolhardy. In such circumstances, instead of attempting a statistical test, the best one can do is to examine the most worrisome cases to see if they reveal a structure or a pattern that is likely to bring trouble to the United States.

Were it not for the tendency of American economists to dismiss the threats from globalization altogether, it might seem labored to begin by asking how seriously host authorities should consider the threat to national security from relying on foreign companies operating from outside national borders. All of the major European powers have experienced the agony of dependence on companies and technologies controlled from abroad, from the Suez crisis of 1956, for example, when the United States threatened to order its oil companies to cut off supplies if the British and French did not withdraw their military forces from the Canal, through the Johnson administration's order to IBM and Control Data to withhold critical computer technology from de Gaulle's nuclear *force de frappe*, to the Soviet gas pipeline case of 1982.

Perhaps the archetypical nightmare came with the effort to constrain the French nuclear weapons program. From 1964 to 1966, the United States refused to issue licenses for export of "high performance" IBM and Control Data computers to the French *Commissariat a L'Energie Atomique*, which forced French work on the hydrogen bomb to "come to a grinding halt."⁴ In political

4. "America Says No," *The Economist*, June 16, 1966, p. 1229; "Computers Denied To France By U.S.," *New York Times*, May 21, 1966, p. 38. The United States also suspended sales of highly enriched uranium to France when it discovered the French were designing a "Polaris type" submarine. Almost a decade later, we now know, Richard Nixon and Henry Kissinger reversed this policy and initiated a program of clandestine assistance to French nuclear weapons development. Richard H. Ullman, "The Covert French Connection," *Foreign Policy*, No. 75 (Summer 1989), pp. 3-34.

terms, the American policy of technology denial helped set the stage for de Gaulle's withdrawal from NATO's integrated military organization and the expulsion of NATO headquarters from France. In economic terms it reinforced the neo-mercantilist moral, "not merely in France, but throughout Western Europe . . . that it is unwise to become over-dependent on [a single source] for the supply of any advanced technical equipment."⁵ If the same were to happen to the United States, via foreign manipulation of superconductivity technology, advanced microelectronics, integrated optics, or any of the other six technology groups (of twenty-two) in which non-U.S. firms have the lead,⁶ it is doubtful that Americans would draw any different conclusion.

In subtly different contexts, U.S. government constraints on European subsidiaries of American firms in Europe (which claimed to be host country citizens but answered to home country instructions) provided a channel for U.S. meddling in the policies of European nations toward Arab states, toward China, toward Cuba, and toward the Soviet Union.⁷ One suspects that the United States would not accept turnabout as fair play with equanimity if it were exercised against the United States in the coming decade.

Overall, the number and magnitude of cases in which foreign manipulation of the global nature of key industries has infringed on the "high politics" of the major nation-states in Europe and Asia is so extensive that the more interesting question is why American economists have tended to dismiss the danger. The answer may be myopia induced by America's atypical historical experience since the end of the Second World War, during which the country enjoyed the brief good fortune of finding that international liberalism and national hegemony spontaneously coincided.⁸

Whatever the reasons for American complacency, the European experience confirms the worst fear of the neo-mercantilist: that dependence on foreign corporations whose key operations take place outside national borders opens up a real threat of interference on the part of their home country governments. More ominous, the dangers to sovereignty and national security may come suddenly and without warning, even when firms are controlled by allies. Reliance on foreign companies and foreign technologies can constitute

5. "Turning a Blind Eye," *The Economist*, October 29, 1966, p. 489.

6. DoD, *Critical Technologies Plan*.

7. Cf. Thomas N. Gladwin and Ingo Walter, *Multinationals Under Fire* (New York: Wiley, 1980).

8. Robert Gilpin, *The Political Economy of International Relations* (Princeton: Princeton University Press, 1987); David A. Baldwin, *Economic Statecraft* (Princeton: Princeton University Press, 1985).

a menace long before imposition of a maritime blockade or emergence of an industrial "fifth column" in the midst of war. Despite the fact that economists can demonstrate that, overall, the liberal paradigm is best, the exceptions should lead the new generation of defense industrial strategists, surveying the prospects for the United States, to conclude that complacency is not at all warranted.

But if dependence on foreign companies may indeed constitute a serious danger to national sovereignty, can the remedy be found simply by substituting reliance on home-country companies (in the words of the Office of Technology Assessment, by "keeping manufacture and development in the hands of U.S.-based or U.S.-owned companies")?⁹

HYPOTHESIS II: REPLACING RELIANCE ON FOREIGN COMPANIES WITH RELIANCE ON NATIONAL COMPANIES RELIEVES THE THREAT FROM GLOBALIZATION

In relatively free market systems (e.g., Germany, the U.K.) as well as more *dirigiste* regimes (e.g., France, Italy), the conviction that having one's "own" corporations as suppliers would better provide for sovereign needs produced a broad collection of "national champion" companies, including oil, computer, and aerospace companies.

The European experience with such national champion companies, however, undermines the hypothesis in two ways. First, having one's own companies provides no protection against foreign manipulation when monopoly or oligopoly concentration in the upstream industry allows foreign governments to dictate how the firms must operate. Second, national firms may demonstrate a proclivity to pursue their own worldwide interests rather than the special interests of their home governments.

From a national security point of view, the case that best crystalized the weaknesses of the neo-mercantilist approach was the oil embargo of 1973. The difference between the "real" oil crisis of 1973 and the would-be oil crises of 1956 (Suez) and 1967 (the Six-day War), is that in 1973 oil production was much more concentrated in the hands of the Organization of Petroleum-Exporting Countries (OPEC) nations (67 percent of non-communist output in 1973 versus 41 percent in 1956), and spare capacity elsewhere in relation to the amount of the cutback by OPEC was much less in 1973 (10 percent

9. OTA, *Holding the Edge*, Summary, p. 37.

spare capacity in the United States in 1973 in comparison to 25 percent in 1956 and 1967).¹⁰

With a choke-hold by OPEC over upstream production in 1973, the parent firms had to obey the marketing instructions of the Arab authorities scrupulously, account for discrepancies, and assist in monitoring the embargo (oil ship captains, for example, had to sign affidavits stating their destinations and report by cable when they arrived, or face losing access to the petroleum supplies themselves).¹¹

Nor were the home governments much more successful in persuading nationally headquartered companies to deal with non-Arab oil in a manner other than what the companies themselves considered their own long-term self-interest. Pressed to give preference to home country markets, at least with discretionary oil, the companies, deciding among themselves to "equalize the suffering" among all customers, refused. In response to Prime Minister Heath's demand that British Petroleum (in which the British government had a 48 percent ownership share) increase deliveries to the U.K., BP announced that it would place contractual obligations above instructions from stockholders.¹²

To be sure, having national companies as players in the international industry was not without value to local authorities. Those companies could have been taken over or coerced into using what freedom they did enjoy to favor the home market for the moment.¹³ Over the longer term, they might achieve a breakthrough, a discovery outside the clutches of OPEC, that would relieve the pressure of foreign dependence. But the overall outcome of the oil crisis ran contrary to the neo-mercantilist paradigm; a country having its own companies as suppliers was not thereby relieved of external vulnerabil-

10. Overall, in 1973, there was spare capacity of one million barrels per day in comparison to a cutback of four million barrels per day. Joel Darmstadter and Hans H. Landsberg, "The Economic Background," in *The Oil Crisis in Perspective* (special issue), *Daedalus*, Vol. 104, No. 4 (Fall 1975), pp. 15-39.

11. Robert B. Stobaugh, "The Oil Companies in Crisis," in *ibid.*, pp. 179-203. Not only the Americans and the Europeans but also the Japanese found the conventional wisdom of neo-mercantilism empty in time of crisis: the Japanese expenditure of \$800 million in 1972 to buy the Abu Dhabi Oil Company, in order to obtain the mythological "assured supply" that only one's own companies can convey, failed totally in moving Japan to the coveted priority list of customers.

12. *Ibid.* According to Stobaugh, France's *Compagnie Française des Pétroles* also allocated its available supplies in a pattern similar to that of the large major oil companies.

13. BP challenged Heath to "have a law passed if he was not satisfied" with their allocations, but the Prime Minister backed down. Stobaugh, "The Oil Companies in Crisis."

ity. As a precursor to the more "modern" nightmare, in which foreign governments exercise quasi-monopolistic control over the disposition of a technology, the case of the oil embargo confirms that the threat from foreign dependence derives from a choke-hold over some external part of the industry, that is, from the structure of the industry itself rather than simply from the nationality of the supplier companies. Changing the latter without changing the former does not add to national security.

There is a more subtle theme as well: national companies may follow their own interests rather than those of their home countries as the companies themselves become globalized.¹⁴ Policies that can woo international companies away from tight allegiances to their home governments, while disappointing to neo-mercantilists (including, as we shall see, to American neo-mercantilists) will turn out to be a useful tool for the new generation of defense industrial strategists.

The theme of "a-national" behavior on the part of multinational companies figures prominently in a further recommendation of the neo-mercantilist approach, a requirement for maintaining production of vital items and utilization of vital technologies on national soil, or, in the words of the Office of Technology Assessment, "keeping key non-defense manufacture and development in the United States."¹⁵

HYPOTHESIS III: INSISTENCE ON PRODUCTION OF KEY ITEMS AND UTILIZATION OF KEY TECHNOLOGIES ON NATIONAL SOIL HELPS ALLEVIATE THE THREAT OF FOREIGN DEPENDENCE

A national soil requirement has the appeal of actually situating the foreign companies that a country depends upon and the technology it needs within the sovereign jurisdiction of the home state. But such an approach, in the European experience, was undermined from the beginning by the proclivity

14. In less-than-crisis circumstances, the neo-mercantilist idea that national firms would give automatic preference to national markets began to bring headaches to home country authorities almost from the moment European governments began to nurture their own national champions. When overseas production sites offered more profits to Michelin than French indicative planning could provide, or when Brazilian negotiators demanded new output from Volkswagen at the expense of exports from Germany, the firms pursued what benefited themselves most or hurt themselves least. The result was that reliance on national companies to meet home country needs became problematic in everyday operations. Raymond Vernon, *Big Business and the State: Changing Relations in Western Europe* (Cambridge: Harvard University Press, 1974); and C. Fred Bergsten, Thomas Horst, and Theodore H. Moran, *American Multinationals and American Interests* (Washington, D.C.: Brookings, 1978), chap. 11.

15. OTA, *Holding The Edge*, Summary, p. 37.

of the United States to place extraterritorial constraints on the activities of American subsidiaries, and to write extraterritorial prohibitions into the licensing agreements between U.S. and foreign firms, a proclivity that might, in the future, be found among Germany's Social Democrats, Britain's Labourites, or Japan's Socialists *vis-à-vis* the activities of their countries' firms in the United States.

While annoying to the Europeans, this level of foreign interference was, however, ultimately manageable. The dimensions of foreign meddling were known in advance, and Rolls-Royce engines could be substituted for Pratt and Whitney, or Ferranti radar substituted for Hughes, if the product were destined for export to a region forbidden to the American subsidiary or the licensee of American technology.

Then came the Soviet gas pipeline case of 1982.¹⁶ In response to the imposition of martial law in Poland, the Reagan administration not only suspended export licenses to the Soviet Union for a broad array of high technology goods, but also prohibited American subsidiaries and overseas licensees of American technology from carrying out pre-existing contracts for sales to the Soviet Union. The Europeans thus faced a new dimension of extraterritorial interference, imposed unilaterally and retroactively on the behavior of firms operating with valid contracts on national soil. In reaction, the British, German, and Italian governments ordered their own firms operating under U.S. licenses to proceed with shipments to the Soviet Union, and France ordered the French subsidiary of Dresser (a U.S. firm) to proceed with the shipment of twenty-one pipeline booster compressors as well.

The result was a standoff. American firms like Dresser were quite literally caught in the middle, facing severe sanctions no matter whose directive they followed. Local licensees, like Creusot-Loire of France or John Brown Engineers of Great Britain, faced retaliation from the United States if they complied with their own governments' instructions. The national soil requirement did provide something tangible for the local authorities to grab hold of as part of the first round of diplomatic jujitsu, but rather than guaranteeing success it could at best do no more than create a stalemate until negotiations moved to a higher political plane.

Even though the outcome ultimately favored the European position, what European authorities learned the hard way was that a strong bargaining

16. Gary Clyde Hufbauer and Jeffrey J. Schott, "The Soviet-European Gas Pipeline: A Case of Failed Sanctions," in Theodore H. Moran, *Multinational Corporations: The Political Economy of Foreign Direct Investment* (Lexington, Mass.: D.C. Heath, 1985), chap. 11.

position and ultimate protection came not from some legal capability to exercise rights of sovereign jurisdiction over activity within their own borders, but rather from arranging alternative suppliers of turbines, pumps, and compressors, diversifying purchases, becoming, in the words of Germany's AEG-Kanis company, "very cautious about any new contracts that would bind us so totally" to a single source of technology and equipment.¹⁷

Should one conclude that the neo-mercantilist requirement that production take place within national borders provides no help against the threat of foreign manipulation and foreign coercion? As long as providers of technology remain concentrated, the channel for foreign control remains open despite sovereign jurisdiction. But the neo-mercantilist may be able to take a bit more solace from the home soil requirement. Local production does constitute a kind of entrapment. It provides a handhold on foreign corporations to help counterbalance the influence of home authorities. Beyond ensuring deadlock in a crisis, as in the Soviet gas pipeline case, it may ultimately lay the foundation for governments to negotiate long-term agreements to stifle the impulse toward extraterritorial control. To make the agreements credible, however, will require a deliberate effort to move away from the neo-mercantilist paradigm and to encourage the interpenetration of technology bases among the United States, Europe, and Japan.

Instead of refocusing the debate away from a preoccupation with the nationality of firms and toward the degree of external concentration in the industry, or away from local production and toward interpenetration, however, the natural impulse in Europe as in the contemporary United States has been to push ahead further in the same direction, to carry the neo-mercantilist approach to its logical extreme, namely, insisting on self-reliance via national companies within national borders as the preferred direction for defense industrial strategy.

HYPOTHESIS IV: AUTARKIC SELF-RELIANCE IN CERTAIN KEY SECTORS OFFERS THE ULTIMATE PROTECTION

The arguments against a policy of self-reliance are immediate and obvious: inefficiency, lack of competition, loss of economies of scale. But why not think more grandly, and turn the economies-of-scale argument on its head? Why not take industries in which a country has world-class companies,

17. *Journal of Commerce*, December 29, 1982, quoted in Hufbauer and Schott, "The Soviet-European Gas Pipeline," p. 238.

ensure them an exclusive place in the home market, and provide them with abundant public resources in the hope they can capture a sufficiently wide global market to provide the requisite economies of scale? The result could serve commercial and security goals at the same time; for this, it might be worth the risk of a little inefficiency at the margin.

As we shall see in the next section's analysis of "strategic trade theory," there is no inherent reason why such an approach might not work, although there are both technological and marketing disadvantages in pursuing it. What the European experience demonstrates, however, is that when the effort is less than successful, it can lead to a nightmare for defense industrial strategists almost as frightening as de Gaulle's specter of total dependency: being tied to a product of such high price, long delays, and inferior technological performance that the user finds his own security compromised.

The most dramatic example of the latter, in the European experience, was the case of the Airborne Early Warning (AEW) Nimrod, the British attempt to create a purely national rival to the Boeing AWACS (Airborne Warning and Control System), to capture part of NATO's "sale of the millennium."¹⁸

Now easily labeled "the most sorry story of all" in recent aerospace history, the argument that "buying British meant buying the best" was not at all implausible early in the race against AWACS (1975-77).¹⁹ The team of Hawker Siddeley Aviation, Marconi-Elliott Avionic Systems, and Rolls-Royce had a strong technical and commercial record, and the AEW Nimrod was an option with numerous distinct advantages: a) design—360 degree coverage from nose and tail radars without tail obstruction; b) endurance—high transit speed plus a capability to loiter with low drag using only two engines; c) technology—commercially proven data-processing equipment for extracting targets from background clutter; and d) price—estimated at 20-40 percent less than the cost of the AWACS, since the development costs of the airframe were already paid for. In short, the proposal to offer an "in-kind" contribution to NATO instead of a financial appropriation for AWACS seemed altogether reasonable.

18. Daniel Todd and Jamie Simpson, *The World Aircraft Industry* (London: Croom Helm, 1986); and Arnold Lee Tessmer, *Politics of Compromise: NATO and AWACS* (Washington, D.C.: National Defense University Press, 1988).

19. Todd and Simpson, *The World Aircraft Industry*; Dan Boyle, "Long Range Protection at a Cost," *Interavia: World Review of Aviation*, October 1975, pp. 1099-1107; and Dan Boyle, "Airborne Early Warning: Two Major Systems for Europe," *Interavia: World Review of Aviation*, September 1980, pp. 694-701.

The reasons for the failure of the project illustrate the weakness of a strictly national approach. As the nature of the threat changed (the Soviet Backfire B and C turned out to be optimized for low-level strikes with supersonic dash), the difficulties of near-real-time data handling and distribution in two separate environments, over sea and over land, escalated.²⁰ Nimrod's inability to reach out for multinational assistance in the face of a rapidly changing set of challenges resulted not so much in any one single technological failure as in a series of delays, price increases, and questionable upgrades of capability. Then, the fact that Nimrod was a year and a half behind schedule when the Falklands conflict unexpectedly left the Royal Navy without sophisticated surveillance or fighter control against Argentine air strikes was simply bad luck.²¹

Left with a trade-off between self-sufficiency and an exposed security position, the United Kingdom finally threw in the towel, scrapping the nine-year-old AEW Nimrod program altogether after spending \$1.6 billion. The decision was not simply pique after the Falklands near-disaster; it sprang from a fear that the country would be stuck for decades with a system whose performance left it vulnerable in ways the AWACS alternative, free to draw on technology from any source, would not.

Boeing, in contrast, had centered its corporate strategy around building a multi-national procurement consortium behind what was ostensibly an "American" aircraft. Borrowing a tactic pioneered by General Dynamics in selling the F-16 to NATO, the corporation offered major subcontractor opportunities to European aerospace and avionics companies.²² As the discussion of "strategic trade theory" below will point out, this strategy simultaneously bolsters the technology base upon which the company can draw to meet needs as they unfold, and creates commercial alliances that dampen pressures for protectionism and retaliation. A transnational production strat-

20. Douglas Barrie, "Delay Dogs UK's Air Defense Plan"; and "Software: The Bugbear in UK Procurement Policy," both in *Jane's Defense Weekly*, Vol. 2, No. 24 (June 17, 1989), pp. 1229, 1267. Strictly speaking, the Nimrod was slightly less than "totally British," since Marconi-Elliott formed a joint venture with the Loral Corporation of the United States to produce a passive signal surveillance and analysis package.

21. The Royal Navy was reduced to positioning radar picket ships along the best guess of Argentine paths of attack, at considerable risk to the destroyers and frigates themselves. Roy Braybrook, "Airborne Early Warning Aircraft," *Jane's Defense Review*, Vol. 4, No. 4 (1983), pp. 909-912.

22. Tessmer, *Politics of Compromise*; John Jones, "Boeing Makes Final Bid for British Contract, Offers To Plow Profits Back Into Nation," *New York Times*, November 12, 1986, p. G3.

egy provides, in Boeing's calculation, "insurance against a wider outbreak of economic nationalism that could inhibit [the company's] overseas sales."²³

The Nimrod case does not prove that the United States would never be able to target certain industries and go it alone. But the case does provide a concrete example of the technological and commercial disadvantages of such an approach in a rapidly changing environment, and underscores for defense industrial strategists the danger of failure in terms more stark than merely losing a little efficiency at the margin.

LESSONS FOR THE UNITED STATES

This examination of Europe's struggle to deal with dependency on foreign companies and foreign technologies provides three lessons:

First, there are dangers hidden in the global nature of industries crucial for the functioning of modern nation-states that pose unacceptable risks to those states, even in peacetime relations among allies. It is not prudent to dismiss the problem of industrial dependency as the liberal economic tradition is wont to do, by advocating that governments simply allow markets to work.

Second, the threat of foreign control is a function of the degree of external concentration in the industries upon which the defense effort depends, not of the nationality of the firms per se. This threat cannot be remedied merely by establishing national companies or insisting on local production by foreigners, so long as a structure of quasi-monopoly in the international industry remains. Diversification and multiplication of the companies and locales upon which a nation can draw offers the most dependable method for minimizing the threat of foreign control.

Third, the impulse to self-sufficient autarky, while appealing, carries its own perils not only in terms of higher cost, fewer units, and delayed deployment, but also from being locked into performance unacceptable for national security requirements.

Once the threat is understood to be foreign control arising from external concentration in key industries, it can be analyzed on a common basis by national security analysts and economists alike. So can the path for finding

23. In the words of Boeing's president, "If we were to bleed off all of the aerospace production, we'd get a backlash that would cause more trouble than sharing to a degree." Luis Kraar, "Boeing Takes a Bold Plunge to Keep Flying High," *Fortune*, September 25, 1980, p. 79. Most high-technology industries have been moving on their own, consequently, in a direction opposite to one of self-sufficient national exclusivity, building transnational corporate alliances instead.

a remedy, since the potential for foreign control decreases in direct proportion to the proliferation of suppliers. The analysis of the European experience suggests that a broad definition of the defense industrial base is most appropriate: any good, service, component, or input to the national economy whose denial could plausibly damage the security interests of the state. This lays the groundwork for a common criterion across sectors for deciding what industries deserve special policy measures.

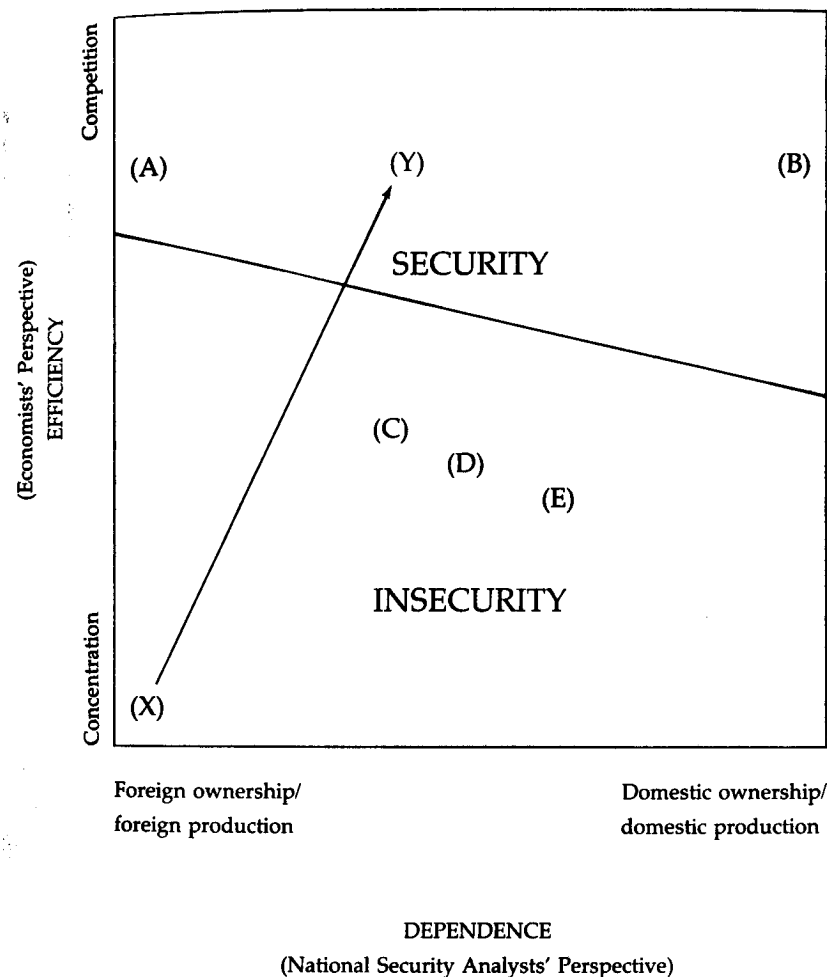
A framework that incorporates these insights might look like Figure 1. Security has to be defined along two axes, degree of concentration and degree of foreign dependence (foreign companies or foreign locales). The worst position is X (the de Gaulle nightmare of total foreign dependency). Moving along the concentration axis, if there is a sufficiently high degree of competition in the industry, security will not be threatened even if most (or all) of the suppliers are foreign companies in foreign locales (point A).²⁴ At the same time, the more competition there is, the more efficient the use of resources, the more innovative the industries, and the closer to world-class performance.

Moving along the foreign dependency axis (dependence on foreign companies or on foreign research and production sites), there is always the enticing possibility of creating an industry that has premier performance and efficiency with no foreign dependency (B). On the other hand, simply mandating direct regulations on the nationality of firms or the location of research and production, as national security analysts are inclined to do, may merely lead the country down a path roughly parallel to but below what is tolerable for security (C, the oil embargo; D, the Soviet gas pipeline; E, the Nimrod case), if it does not simultaneously result in a multiplication and diversification of suppliers. Toward the end of the foreign dependency axis, there will be a broad area in which the country finds itself close to self-sufficiency but locked into a condition of mediocrity damaging to national security.

I shall argue in the next section that the dividing line between "security" and "insecurity" can be determined empirically in a way identifiable and measurable by defense industrial strategists. The slope from left to right, is, I shall explain, a function of the clout exercised over suppliers by home country authorities.

24. To guard against a hypothetical blockade of sea lanes in time of war, a prudent defense industrial strategist might wish to have some of those suppliers in contiguous countries, or maintain a small stockpile. But strategists will not want to devote much money or attention to these industries simply to guard against the threat of foreign control in an era of globalization.

Figure 1. A Common Framework for Economists and National Security Analysts.



Key:

- X = de Gaulle nightmare of total foreign dependency
- A = competitive foreign suppliers
- B = competitive domestic suppliers
- C = the oil embargo
- D = the Soviet gas pipeline case
- E = the Nimrod case
- Y = multiple foreign and domestic suppliers

Overall, the most useful result from examining the European experience comes not in criticizing (or rejecting) either the liberal or the neo-mercantilist perspectives, but in trying to reconcile them. The desire for efficiency and national control can be pursued in complementary rather than contradictory fashion if regulation of the nationality of companies and of the location of production can multiply the sources upon which the defense effort depends. Simply letting market forces predominate and globalization run its course, as economists typically recommend, may not accomplish the task of diversification. Simply insisting on having one's own companies or having production within one's own sovereign jurisdiction, as national security analysts typically recommend, may not eliminate the specter of foreign dependence.

The challenge for the new defense industrial strategist, therefore, is to devise policies that use requirements for national ownership and for research and production on national soil as interim measures to enhance home country control over suppliers, that stimulate (not block) the proliferation of those suppliers, and that avoid condemning the country to mediocre performance in the process. The optimum approach channels neo-mercantilistic impulses into a path that moves from point X to point Y.

Managing The Process of Globalization in American Defense Industries

What policies are most appropriate to strengthen the defense industrial base of the United States in an era of globalization, avoiding foreign control while ensuring superior performance? There is broad agreement about the need for improvement in generic "macro" policies to enhance American competitiveness; there is broad disagreement about the need for sector-specific "micro" policies to apply to individual industries.²⁵

The generic policies include measures to reduce the budget deficit, increase savings, stimulate investment, improve education, and strengthen productivity. For most American economists, getting-generic-macro-policies-right is enough. Not so for industrial policy theorists. In their view, maintaining a

25. Even if generic macro policies and sector-specific industrial policies were without flaw, it is surely illusory to imagine that any one country would achieve supremacy in every sector, every process, and every input. In the ultimate irony, however, even if such a supremacy were achieved, the United States defense effort would still be better off specializing among activities, devoting the bulk of scarce American resources to those areas where comparative advantage was greatest. In short, some degree of globalization of the defense industrial base is here to stay, and will have to be managed no matter what.

strong national economy in a world of growing international competition requires an extra dimension of fine-tuned efforts to promote cutting-edge industries, preserve threatened ones, and regulate foreign acquisitions and foreign investment. Previously on the wane, their arguments are gaining new life in the search for ways to strengthen the defense industrial base.²⁶ For them, Sematech and the Semiconductor Agreement (see below) are just the beginning of a new wave of public interventions needed across the spectrum of leading and lagging industries.

The analysis in the preceding section, about the nature of the threat from foreign suppliers and the utility of substituting national companies or local production to meet that threat, can be of help in determining appropriate approaches for specific sectors in the United States.

PROMOTING THE CUTTING EDGE

Turning first to the stimulation of new technologies, there is a well established literature on the need for government intervention in the marketplace.²⁷ The rationale for such intervention springs from the appropriability problem, that firms may be unable to capture all of the benefits from their own R&D (research and development) expenditures. They will therefore tend to underinvest in research and development, leaving a shortfall in the optimum amount of resources and risk-taking, a shortfall which government should try to fill. This appropriability justification for public intervention is

26. Testimony of Arden Bement, Pat Choate, Stephen Cohen, and Robert Kahn, *Government's Role in Economic Competitiveness*, Hearings before the Committee on Governmental Affairs, U.S. Senate, 100th Cong., 1st sess., March 25–April 7, 1987 (Washington, D.C.: U.S. GPO, 1987); *Economic Competitiveness, International Trade, and Technology Development Act of 1987*, Report of the Committee on Governmental Affairs, U.S. Senate, June 23, 1987 (Washington, D.C.: U.S. GPO, 1987); *Defense Production Act Amendments of 1988*, Hearings before the Subcommittee on Economic Stabilization of the Committee on Banking, Finance, and Urban Affairs, House of Representatives, 100th Cong., 2nd session, March 30–31, 1988 (Washington, D.C.: U.S. GPO, 1988); Stephen S. Cohen and John Zysman, *Manufacturing Matters: The Myth of the Post-Industrial Economy* (New York: Basic Books, 1987); Clyde V. Prestowitz, Jr., *Trading Places: How We Allowed Japan To Take The Lead* (New York: Basic Books, 1988). The literature on the defense industrial base shows considerable ambivalence toward industrial policy. The Defense Science Board concluded, for example, that the United States needs "to begin the process of establishing and implementing a coherent national industrial policy in support of our national security interests." *The Defense Industrial and Technology Base*, p. 42. The report of the undersecretary of defense for acquisitions was much more equivocal; DoD, *Bolstering Defense Industrial Competitiveness*, chap. II.

27. Christopher Freeman, *The Economics of Industrial Innovation* (Cambridge: MIT Press, 1982). R.C. Levin, A. Klevorick, R.R. Nelson, and S.G. Winter, "Appropriating the Returns from Industrial Research and Development," *Brookings Papers on Economic Activity*, No. 3 (Washington, D.C.: Brookings, 1987).

reinforced, for defense industrial strategists, by a country's interest in having a risk-management policy analogous to wildcat drilling in the oil industry. Whereas wildcat oil strikes come in highly unpredictable fashion from exploratory drilling in many potential basins, most of which ultimately turn out to be dry holes, those few that turn into gushers have great impact on the relative position of all the players in the oil business. A major country, like a major oil company, will want to foster some drilling, so to speak, in all the basins where others have rigs, so as to provide intelligence on what others may achieve, to ensure against surprises as well as to gamble on a discovery or two of its own. In the national security arena, the histories of ECM (electronic countermeasures) and anti-ECM, ASW (anti-submarine warfare) and anti-ASW, or armor and anti-armor technologies illustrate the value of the wildcat-discovery/protection-against-surprises approach.

Consequently, defense industrial strategists have good reason to encourage the U.S. government to fund the search for innovations all along the technological frontier. Despite popular preoccupation with the ideological aspects of government intervention, the key issues for debate in fact lie somewhat apart from ideology, since the purpose of expending public resources is not to replace the market but to perfect it, not to pick winners better than the market but to construct a showcase of candidates which otherwise would not be available for the market to appraise. The important questions are: what kind of activities should public monies and public risk-taking support, and, harking back to the dilemmas of neo-mercantilism, should nationality requirements or national soil requirements be criteria for eligibility?

The literature on technological innovation offers some help in identifying the kinds of activities worthy of public support. Technological discoveries proceed through two broadly predictable stages.²⁸ In the first stage there are uncertainties about the objective to be achieved, the process to achieve it, and perhaps about the basic physical principles involved. These uncertainties intensify the appropriability problem as private investors ponder where the research is going and whether there will ultimately be any cost-effective use. The second stage begins after uses and processes are clarified.²⁹ There are

28. James M. Utterback, "Innovation and Industrial Evolution in Manufacturing Industries," in Bruce R. Guile and Harvey Brooks, eds., *Technology and Global Industry: Companies and Nations in the World Economy* (Washington, D.C.: National Academy Press, for the National Academy of Engineering, 1987); Merton J. Peck and Frederick M. Scherer, *The Weapons Acquisition Process: An Economic Analysis* (Boston: Division of Research, Graduate School of Business Administration, Harvard University, 1962).

29. In DoD usage, the principal division comes after budget categories 6.1 (research into basic

greater opportunities to estimate costs, evaluate demand, and let the market allocate resources to projects which are most promising. While the dividing line between the two stages is somewhat elastic (many analysts break the cycle into a number of sub-stages), the strongest justification for public sector intervention clearly comes toward the beginning, when the combination of risks and uncertainties is greatest, the appropriability problem the largest, and any given amount of public resources can provide the most seed money and insurance coverage over the most extensive range of projects. The second stage falls into the range where public support (always welcome by the recipients) largely substitutes for funds or risk-taking which private investors are able to handle by themselves.

This distinction provides a useful hierarchy for government funding of projects along the technological frontier, with the early phase (research, feasibility) taking definite precedence over the later one (development and commercialization). The defense industrial strategist shares this hierarchy with other equally legitimate claimants, e.g., for health, environment and basic science.

For the portion of available funds the defense industrial strategist is able to secure in the competition with non-defense uses, the first priority will be stage one (research and feasibility) projects with high potential defense pay-offs but limited commercial prospects. (See Figure 2.) These projects have the least likelihood of coming to fruition on their own if the government does not take the lead. Current examples include advanced electronic countermeasures, hardening of C³I (command, control, communications, and intelligence) systems against electromagnetic effects from nuclear weapons, super-precise navigation, and broad-spectrum signature control.³⁰

The second priority will be stage one (research and feasibility) projects with high potential defense payoffs and also dual-use commercial applications. Current examples include research on gallium arsenide and optically-based computer technology, creation of sensitive materials for x-ray lithography to achieve 0.50-or-less micron semiconductor features, and achieve-

and applied sciences), 6.2 (exploratory development of practical applications of that research), and 6.3A (building of prototypes to demonstrate the principle of an application). Budget categories 6.3B and 6.4 cover the development of specific systems leading to procurement. In practice the classification of individual projects has become quite elastic.

30. These and subsequent examples draw on DoD, "Statement of Dr. Raymond S. Colladay, Director, Defense Advanced Research Projects Agency (DARPA) to the 101st Congress," April 26, 1989.

Figure 2. Cutting-Edge Technologies: Priorities for Government Intervention.

Traditional Approach		Industrial Policy Approach	
Research, Feasibility, Prototype Stage		Development and Commercialization Stage	
Low Commercial Use (Not Dual Use)	High Commercial Use (Dual Use)	Low Commercial Use (Not Dual Use)	High Commercial Use (Dual Use)
<ul style="list-style-type: none"> • next generation ECM (electronic countermeasures) • non-acoustic ASW (anti-submarine warfare) • broad spectrum signature control (stealth) • "brilliant guidance" (super-precise navigation) • hardening of circuitry against EMP effects • experimental processes for shaping ceramic composites • building neural nets for pattern discrimination 	<ul style="list-style-type: none"> • very large-scale integrated (VLSI) circuit technology, with high density 3-D chip packaging • gallium arsenide and optically based computer technology • experiments with parallel processing (mini-supercomputers) • creating critical densities for bulk and thin film superconductors • creation of sensitive materials for x-ray lithography, to produce 0.50 or less micron features • quantum tunneling for 1000x reduction in size and power of electronics 	<ul style="list-style-type: none"> • next generation ECM (electronic countermeasures) • broad spectrum signature control (stealth) • production of ceramic composite armor • production of automatic target recognition systems with neural nets • manufacturing technology for millimeter wave and microwave integrated circuits (MIMIC) for smart weapons • production of hypersonic vehicles and guidance systems 	<ul style="list-style-type: none"> • derivatives of "brilliant guidance" (precise navigation) • very large-scale integrated (VLSI) circuit chip products • development of supercomputers using gallium arsenide chips • development of mini-supercomputers base parallel processing • producing mile length superconducting wire • making HDTV computers with current TV sets • production of 0.5 micron or less semiconductor wafers
High Value Defense Payoffs		Basic Science (Uncertain Defense Payoffs)	
<ul style="list-style-type: none"> • supercollider 		<ul style="list-style-type: none"> • manned space station 	
Low/Indirect Defense Payoffs		<ul style="list-style-type: none"> • AIDS research • health research • environmental research 	
		<ul style="list-style-type: none"> • AIDS pharmacology • clean coal burning process 	

ment of critical densities for bulk and thin-film superconductors. These are second in priority not because they are less important, but because greater intrinsic private interest is likely even if the government plays a more muted role.³¹

A third priority is direct government involvement in stage two (development and commercialization) projects with high defense payoffs but low commercial use. Projects at this stage should probably fall under the rubric of ordinary procurement, rather than public participation in risk-taking and funding of operations. But the overlap between feasibility experiments, production of first generation prototypes, test and evaluation of performance, and redirection of research efforts may be so intimate that a case can be made for direct use of government funds, government risk-taking, government scientists, and government labs.³² To give some current examples, it may be necessary to spend scarce R&D monies not only to create processes for shaping ceramic composites, but also to help produce ceramic composite armor, or not only to create technology for millimeter-wave and microwave integrated circuits, but also to help produce target recognition packages for smart weapons.

Last priority would be direct government participation in stage two (development and commercialization) dual-use projects where commercial applications are especially high.

However, the resurgence of interest in a sector-specific industrial policy to support the defense industrial base turns this approach on its head, giving highest priority to projects with the largest dual-use potential, and shifting emphasis from the early experimental phase to the later development phase in an effort to speed the commercialization of new products.

Such a reversal of priorities in public funding has two unfortunate implications: First, a potential major misallocation of scarce budgetary resources;

31. One would expect to see the defense industrial strategist favoring projects with defense applications only, rather than dual-use projects, on the assumption that the latter will have stronger civilian proponents unless, for tactical political reasons, joining forces with dual-use contractors might gain both a larger share of the overall pie *vis-à-vis* nondefense supplicants.

32. For example, on the recommendation of the Packard Commission on Defense Acquisition, DARPA has moved into prototyping, feasibility demonstrations, and the production of experimental vehicles. Further justification for public sector involvement in this area is that the size of defense procurement of many sophisticated items in this non-dual-use area is relatively small in comparison to the other commercial operations of the supplying firms, requiring the government to sweeten the pot by adding funds and bearing risks to get the level of cooperation and responsiveness it needs. OTA, *The Defense Technology Base*, pp. 15, 81.

second, and more serious, a large opportunity cost in terms of next generation defense-related technology.³³

With the new approach, there will be a widening appropriability gap for breakthroughs at the cutting edge and shrinking insurance policy coverage against breakthroughs by adversaries.³⁴ U.S. government spending for current industrial policy favorites (e.g., to make HDTV [high-definition television] compatible with current television sets, to create superconductivity rail transport, or to develop hypersonic commercial aircraft), will come at the expense of multi-spectral radar and infrared focal plane arrays. Moreover, since later-stage commercialization projects generally require much larger outlays than early stage prototypes (the rule of thumb is 3:1 but the actual ratio, demonstrated in government spending for the development of com-

33. If governmental resources were abundant, the misallocation problem might be relatively tolerable. It would still not make sense to concentrate public funding where there is a clearly defined end-product with a ready commercial demand for which the operational techniques have already been demonstrated to be feasible and the remaining challenge of actually creating the product (while formidable) is essentially technical: for instance, whereas there is strong justification for having expended tens of millions of dollars in public funds on supercomputer technology to demonstrate (on the one hand) that multiple parallel processing was feasible or (on the other hand) that gallium arsenide circuitry for faster single-line processing was feasible, here is much less justification, if any, for a surge to \$2 billion in public funds to be given to established supercomputer and mini-supercomputer companies to assist in the development of commercial products when all of the recipients have access to normal financial markets. Similarly, here may be excellent justification for public funding of ten-million-dollar experiments with new materials whose creation might make practicable the fabrication of 0.5 micron and 0.35 micron semiconductors, but the expenditure of twenty-five to fifty times as much (\$500 million; the U.S. government share in Sematech) to participate in an enterprise which prepares commercial technology to produce the 0.5 micron and 0.35 micron chips for transfer to and use by the private partners in that enterprise, does not pass the same public interest test. The result will be an inefficient use of public monies. In an environment of increasingly limited government resources, the opportunity cost in terms of projects that will go begging takes on proportions or the defense industrial strategist much larger than the mere inefficient use of public funds. Within any given level of budget for defense-related research, shifting priorities to the commercialization end of the spectrum is certain to mean cuts, *ceteris paribus*, in early research and feasibility studies; shifting priorities to dual-use projects is certain to mean cuts, *ceteris paribus*, in high-value defense projects with limited or uncertain commercial use. The allocation of \$500 million for near-term creation of silicon-based 0.5 micron semiconductors may mean many fewer \$10-million experiments on optically-based systems for the future; \$2 billion for assistance in the production of supercomputers and mini-supercomputers may mean many fewer \$50 million research projects to develop transistors that use quantum tunneling (which allows 1000x reductions in size and power). Instead of being a "technology driver," the contemporary industrial policy approach would turn U.S. government activities into a "technology rider."

34. During the years of the Reagan military buildup, the amount of the RDT&E budget (Research, Development, Testing, and Evaluation) devoted to the early exploration phase of the technology cycle declined in absolute as well as relative terms, from \$3.4 billion in 1982 to approximately \$2.8 billion in 1988 in inflation-adjusted dollars. Bruce D. Berkowitz, "Reviving defense R&D," *Issues in Science and Technology*, Vol. 5, No. 2 (Winter 1988-89), pp. 53-60.

mercial semiconductor technology by Sematech, may be 50:1 or more), the drain in the wrong direction carries a built-in multiplier.

This analysis hardly provides a ringing endorsement for Sematech, still less for the proliferation of the Sematech model, and less still for the creation of a new civilian equivalent of the Defense Advanced Research Projects Agency (DARPA) to spearhead industrial policy initiatives across the spectrum of commercial technology. Might there not be, however, some overlooked rationale, some overriding new reason that would justify such a costly and risky shift in public policy?

There are three arguments advanced in favor of the renewed enthusiasm for industrial policy. The first is that American businesses have too short a time horizon and consequently neglect research and development (R&D), which requires government intervention to correct. But the excessively short time horizons of American businesses can be helped by, for example, reinstating the investment tax credit or changing the treatment of capital gains. The relative neglect of R&D can be addressed in a more straightforward manner by restoring the R&D tax credit or raising the ceiling on capital losses for venture capitalists.³⁵ While there are legitimate debates about how best to structure such proposals, the task of public policy makers is to find an effective way to deal with deficiencies in American business administration without the immense negative side effects of the new industrial policy recommendations.

Second, it is argued that "high risk, high impact" economic sectors have their own appropriability problems and therefore deserve special governmental support. But the assertion that there is a special appropriability problem associated with commercial development of "high risk, high impact" economic sectors does not ring as true as it did when applied to the early research and feasibility stage. Intuitively one would expect these to be the very areas where private parties can most easily capture the returns from

35. A useful summary of policy recommendations is presented in Michael L. Dertouzos, Richard K. Lester, and Robert M. Solow, *Made in America: Regaining The Productive Edge* (Cambridge: MIT Press, 1989), chap. 4 and Appendix I. A key link between poor macro policy and poor micro performance can be seen in the relationship between the high cost of capital and the planning horizon of American executives. Using the after-tax capital cost estimates of B. Douglas Bernheim and John B. Shoven (a weighted average of 5.5 percent for U.S. firms versus 2.8 percent for Japanese firms), an investment by an American firm must break even in under six years to be worthwhile, whereas an investment by a Japanese firm has 10.3 years to break even. Louis S. Richman, "How Capital Costs Cripple America," *Fortune*, August 14, 1989, pp. 50-54.

their investments if the commercial prospects are genuinely good. Nor does the possibility of a structural problem of "market failure," because the development and commercialization stage of high tech projects often involve large amounts of capital and high degrees of risk, appear consistent with the evidence. American capital markets handled \$370 billion in large transactions (above \$100 million each) in 1988, for example, most of which require many years of uncertain returns at higher than normal risk to work out successfully. Whatever else one may conclude about the workings of U.S. capital markets, the assertion that they lack the structural capability to handle big investments under great uncertainty is hard to reconcile with the data. The fact that venture capital is not spilling forth for high definition television, hypersonic commercial air transport, and superconductivity-based railroads is not *prima facie* evidence that government intervention is required. Even in a perfect allocative system, fascinating projects get turned down or are made to wait as the need for them ripens.

One cannot completely dismiss the possibility of an appropriability problem in the commercialization stage of high technology projects. There is insufficient evidence of the kind needed to make that judgment: good appropriability measures do not exist for all stages of all high tech industries (although, ironically, there are good appropriability measures for semiconductors, which turn out to be than higher than average, indicating scant need for public support).³⁶ The best counsel, therefore, is probably caution and prudence. Before shifting the focus of public policy, defense industrial strategists should insist that the burden of proof be on the proponents to show that a genuine appropriability "gap" exists and, further, to show that the gap is more serious there than at earlier stages of generating new technology and, further yet, to show that it is so serious as to warrant the opportunity costs which will ensue. Pending such demonstration, the appropriate conclusion is that the greater the use of limited government resources on behalf of projects for present-day use, the greater will be the shortfall in tomorrow's breakthroughs.³⁷

36. Levin and Reiss have found that expenditures of semiconductor firms on R&D have a positive and significant elasticity for their own earnings, above the average for American manufacturing industries in general and greater than other "high elasticity" industries such as chemical processing, indicating robust appropriability conditions. Richard C. Levin and Peter C. Reiss, "Cost-reducing and Demand-creating R&D with Spillovers," *RAND Journal of Economics*, Vol. 19, No. 4 (Winter 1988), pp. 538-556.

37. Contrary to most current recommendations, defense industrial strategists will probably not want to endorse calls for closer integration of national security policy and national economic

The third argument for an industrial policy urges the United States to retaliate against targeting on the part of other governments by countertargeting on its own: if the Europeans and Japanese have used this technique in the past to promote the commercialization of certain of their own high tech industries, so the argument goes, the United States should now mimic them. The conventional economic response is: if they want to use their own taxpayers' funds to subsidize consumers in the United States, let them; but it makes no sense for the United States to match them in their folly. In Milton Friedman's words, "The Japanese hurt themselves, and us, when they interfere with free trade by restricting imports or by subsidizing exports. But we can only increase the hurt, to us, and to them, if we retaliate by following an equally unwise policy."³⁸ That response, while not incorrect, is too pat, as we shall see, when industries vital to national security are threatened. The best way to deal with such situations does not require a shift to commercial countertargeting, with all the negative side-effects this would entail (see below).

Before moving to the issue of how to provide for industries that are being damaged, even wiped out, by foreign competition, however, there is a final issue of growing importance for U.S. policy toward the cutting edge: not only what kinds of projects should public monies support, but who should be eligible to receive them? Should American companies planning to take publicly funded technologies to offshore production sites (like the fourteen Sematech participants) be eligible? Should foreign companies pledging to locate R&D facilities or production facilities in the United States (as Sony has applied to DARPA to do) be eligible? Foreign companies now represent an enormous reservoir of commercial experience and superior technology: more than one-fourth of the technologies identified by the Defense Department as most crucial for future defense needs. Their absolute size as well as relative proportions are almost certainly going to grow over time. How can American policy toward high tech industries be designed to incorporate the best, yet avoid opening channels for foreign manipulation and foreign control?

policy in the efforts to promote the development of new technologies. Unless they anticipate that riding on the coattails of "commercial applications" enthusiasts will gain them net additions to their own funding programs, they would be better served by keeping their own appropriations process under authority of defense committees in Congress, and highlighting the opportunity costs whenever late-stage commercialization proposals try to edge in for a greater share of the funds available.

38. Milton Friedman, "In Defense of Dumping," in *Bright Promises, Dismal Performance: An Economist's Protest* (New York: Harcourt Brace Jovanovich, 1983), p. 174.

Fortunately the lessons of the previous section can help avoid the unproductive neo-mercantilist leads and dead-ends suffered elsewhere, since the confusion in American policymaking comes, just as in Europe, from defining the threat of foreign dependence in terms of the nationality of the suppliers and the location of the research and production sites, rather than in terms of the concentration of the external industry. The solution for the United States, within the framework established in the first section of this article, is to use control over the neo-mercantilist variables (nationality of firms, location of production sites) to stimulate the multiplication and diversification of suppliers.

To take advantage of the benefits of foreign technology, while lowering the potential for foreign control to an irreducible minimum, the United States should allow companies from allied or quasi-allied nations to participate in all high-tech programs, but require them, like the American participants, to carry out the proposed R&D at facilities in the United States, and specify that subsequent production must be sited either in the United States or in a third country, but not in the foreign participant's home country unless it could be demonstrated that dispersion in the industry had already reached some critical threshold.

As a first approximation of the critical threshold, the defense industrial strategist can draw on standard measures of oligopoly strength, for example, that no four countries or four companies supply more than fifty percent of the arm's-length world market. This 4/50 rule of thumb, which has proven useful in economic and anti-trust policy, suggests that if four actors control less than fifty percent of a market, the difficulties of collusion overwhelm their ability to coordinate policy even if they share a common objective.³⁹ The 4/50 rule applied to countries would complicate collusion for political

manipulation; the 4/50 rule applied to companies (see below) would complicate corporate collusion on oligopoly pricing or other predatory practices that discriminate among buyers (e.g., delayed delivery of new products), of which the Japanese have been accused. The requirement for the location of R&D facilities in the host country would increase the clout of the United States in a potential confrontation with the home country of the firm. The requirement (for U.S. corporations as well as foreigners) that offshore sourcing of products using publicly sponsored technology would have to take place in a "third country," not among any four supplying fifty percent of the world's arm's-length market, would speed the dispersion of production sites. The objective of using the 4/50 rule would be to weaken and complicate the ability of home governments to exercise effective extraterritorial *diktats*, and that of corporations to consolidate oligopolistic control over an industry. The end result would be to promote efficiency and strengthen national control at the same time.

Of course there would be leakage and cross-fertilization of new technologies and new processes throughout any given corporation's internal network, including its home country facilities. This would undermine the use of cutting-edge funding to gain advantage in a one-upsmanship battle with other industrial nations. So the logical next step would be to construct parallel arrangements among the major industrial economies. All major countries should find it in their interests to develop roughly comparable rules for public funding of frontier industries (e.g., Esprit, Eureka and Jessi in Europe; MITI in Japan), allowing companies of all friendly nationalities to be eligible for support, so long as they carried out the R&D locally and, following the 4/50 rule, did not move production back to a centralized location in their own home country or to another one of the four nations supplying 50 percent of the market. The four country/four company rule would provide a sound framework for negotiating reciprocal access across developed country programs for promoting high tech commercial applications.

This approach does not absolutely "solve" the problem of foreign control. A foreign corporate participant might develop a process for which it became the sole supplier, or one of a small group (less than four) of suppliers who controlled more than fifty percent of the market. Having its R&D facilities and its production facilities located within the United States (or at least outside of the home country) would increase the clout of the U.S. government over the home government of the firm. But in a hypothetical future crisis of conflicting extraterritorial directives, the result might still be no better than

39. The 4/50 rule proposed here is no more than a starting point for determining what might ultimately constitute the most appropriate concentration measure. An alternative concentration ratio is eight firms supplying seventy percent of the world's arms-length market. Employment of the Herfindahl-Hirschman Index to calculate the degree of concentration, as the U.S. Department of Justice already does in its guidelines on mergers, weighs the presence of a few extra-large firms more heavily. What measures of concentration to adopt and what level of specificity to use for purposes of delineating an "industry" require more extended research. The important point for the analysis here is to introduce the concept of using global concentration ratios for the task of appraising potential threats to national security. Joe S. Bain, *Barriers to New Competition* (Cambridge: Harvard University Press, 1956); and F.M. Scherer, *Industrial Market Structure and Economic Performance* (Chicago: Rand McNally, 1980). For an approach that is conceptually similar, see Albert Hirschman, *National Power and the Structure of Foreign Trade* (Berkeley: University of California Press, 1945).

confrontation and stalemate, as in the Soviet gas pipeline case. While this is a better position for the United States than having the foreign firm control the technology and the production from a location in its home country (the "de Gaulle nightmare"), it is far from perfect. To deal with potential confrontation and stalemate situations, an international agreement on extraterritorial dictates, together with a dispute settlement mechanism, will be required (see below).

PRESERVING THREATENED INDUSTRIES

What should be done about industries crucial to national security that are shrinking on account of foreign competition? Despite heavy use of terms like "preserving" and "defending" the local production base, trade protectionism is a highly unattractive option. From an economic point of view, trade protection results in less efficient production, higher prices, and lower levels of innovation which, in turn, constitute a drag on the performance of the entire defense effort. Notwithstanding the premise of most studies emanating from the Department of Defense and the Congressional Armed Services committees, the more "central" the protected sector is to the economy, the greater the drag and the less attractive the protectionist option. For any given level of defense spending, there is less sophisticated, deliverable, reliable bang for the buck with protection than without. Reinforcing the negative economic assessment, from a political point of view, trade protection puts in place a structure of domestic groups with both the self-interest and the (publicly generated) resources to try to maintain a shelter from competition and innovation as long as possible. Taken together, these considerations constitute strong advice against the protectionist route.

On the other hand, should not the presumption against trade protectionism be modified in some way to deal with the specter of foreign control? What if whole sectors of the domestic economy were to get wiped out? Is not guarding against manipulation and coercion from abroad worth some "national security premium" in terms of economic efficiency?⁴⁰ Key to resolving this quandary for the defense industrial strategist is the definition of the threat to national security developed in the first section. The real test for

40. Cf. the rationale for a national security premium for imported oil. Harry G. Broadman and William W. Hogan, "Oil Tariff Policy In An Uncertain Market," Discussion Paper (Cambridge, Mass.: Energy and Environmental Policy Center, John F. Kennedy School of Government, Harvard University, November 1986).

whether a threat to national security exists is not whether a subsector of a particular industry appears headed for extinction on American soil, but whether the emerging array of suppliers is so concentrated that it offers the potential for foreign political interference. It is a mischaracterization of the potential for globalization to focus on the *extent* of dependence on foreign suppliers when the real issue is the *concentration* of dependence on foreign suppliers.

An absence of external concentration (no four countries or four firms supplying more than fifty percent of the world arms-length market) signifies the absence of an external threat and denotes the absence of any rationale for preserving the local producers.⁴¹ For example, the defense industrial strategist should judge a plea to protect the domestic footwear and textile industry ("so that American soldiers will have boots to march and uniforms to fight in") not on the basis of whether most or even all of the suppliers are located offshore, but whether the distribution of those suppliers is sufficiently dispersed that coordinated denial is impracticable (point A in Figure 1). Even wartime disruption of sea lanes is better handled via stockpiles or publicly funded spare capacity than by on-going protection for an inefficient industry.

At the same time, the presence of external concentration signifies the existence of an external threat, and indicates a need for some form of trade protection as a tool in the policy kit of the new defense industrial strategist.⁴² Despite an expectation of peaceful tranquility along sea lanes, the defense industrial strategist will not want to allow the domestic industry to fade away if foreigners retain a tight choke-hold over external suppliers.

41. In calculating the extent of the arms-length market, long-term contracts and other mutual supply arrangements among otherwise unrelated parties should be counted. One would expect users and producers to create mutual dependencies among each other as a way of protecting themselves against cutoffs. Such patterns of informal vertical integration have long been a corporate response to provide "secure access" to sources of supply on the one hand and to distribution networks on the other. For the classic work in this field, see John E. Tilton, "The Choice of Trading Partners: An Analysis of International Trade in Aluminum, Bauxite, Copper, Lead, Manganese, Tin, and Zinc," *Yale Economic Essays*, Vol. 6 (Fall 1966), pp. 31-74.

42. Strictly speaking, trade protection is still a second-best solution. The first-best solution would be to subsidize a given level of domestic production with on-budget public funds. In the past this approach has not proved feasible. (For the failure of such efforts in the machine tool industry, see sources cited in note 46.) Stockpiling is another option. A relatively modest stockpile of subcomponents for precision guided munitions costing no more than \$20 million, for example, can protect a multibillion-dollar sector of the economy against an unanticipated cutoff from overseas sources. Martin Libicki, Jack Nunn, and Bill Taylor, *U.S. Industrial Base Dependence/Vulnerability Phase II—Analysis* (Washington, D.C.: National Defense University, November 1987).

The objectives during this interim period are to moderate the pace of shrinkage in the threatened industry, provide on-going incentives for modernization, and minimize the drag on other industries.⁴³ While it is legitimate to pay some national security premium in achieving these objectives, the defense industrial strategist will want to avoid policies that make the costs of dealing with a transitional threat permanent and, above all, to shun policies that solidify the oligopolistic structure of the industry worldwide, which would exacerbate the potential for foreign control beyond the borders of the United States.

What form of national security protection would temper the impact of foreign competition? And how should the defense industrial strategist deal with unfair competitive practices, including targeting, subsidizing and dumping, by other nations? Does the concern about inefficiency require the defense

43. In seeking the appropriate mix of protectionism in some instances and not in others, the defense industrial strategist can take comfort from two empirical phenomena. First is the discovery that the popular scenario, in which whole industries in developed countries are wiped out, is much less frequent than commonly thought. By far the more typical outcome is intra-industry specialization across borders rather than a single country having "all" of one industry, with another country finding its industry eliminated. A substantial amount of trade among nations in fact falls into the same sectoral categories. While this does not solve the problem of foreign control, it renders national security concerns much more manageable and counsels strongly against blanket protection for an entire industry. Second is the observation that, as industries mature, the barriers to the entry of new competitors tend to decline, resulting in more dispersed and deconcentrated suppliers. The cases of steel and machine tools, of legitimate preoccupation to the United States for security reasons, have shown both tendencies as they have evolved. Semiconductors appear to be headed in the same direction. Taken together, the natural trends toward intra-industry specialization and diffusion of suppliers mitigate the worst fears. The challenge for the defense industrial strategist, therefore, is less likely to take the form of having to make an agonizing absolute decision whether a threat exists and whether protection is justified, and more likely to involve a far easier assessment about how the country might prudently handle the interim period while observing whether an offshore industry is becoming sufficiently deconcentrated to obviate the problem of foreign control. In designing an appropriate policy to meet the cases of legitimate threat, the key concepts are managing a transitional danger and minimizing the burden on the economy in general and on the defense effort in particular. Robert M. Stern, "Testing Trade Theories," in Peter B. Kenen, ed., *International Trade and Finance: Frontiers For Research* (New York: Cambridge University Press, 1977); David Greenaway and Chris Milner, *The Economics of Intra-Industry Trade* (Oxford: Basil Blackwell, 1986). Charles Schultze reports that in major countries very few industries have less than 30 percent of their trade as intra-industry trade; in most industrial sectors, there are significant volumes of both imports and exports, rather than exclusively one or another. Charles L. Schultze, "Industrial Policy: A Dissent," *The Brookings Review*, Vol. 2, No. 1 (Fall 1983), pp. 3-13. For the dispersal of technology as part of the product cycle, see Raymond Vernon, "International Investment and International Trade in the Product Cycle," *Quarterly Journal of Economics*, Vol. 80 (May 1966), pp. 190-207; and Richard Caves, *Multinational Enterprise and Economic Analysis* (New York: Cambridge University Press, 1982), chap. 2.

industrial strategist to be soft or hesitant in retaliating against unfair trade practices on the part of commercial rivals?

In choosing among protectionist measures, tariffs and quotas have substantially different implications for the defense industrial strategist. A tariff acts as a tax on the imported product collected by the government of the importing country. It provides domestic producers with a price advantage equal to the size of the tariff. Above that price, external producers from any country can continue to supply the domestic market, thereby maintaining competitive pressures for innovation, modernization, and adjustment on the local industry. Quotas, on the other hand, fix the amounts that external producers can supply to the domestic market no matter how high the local industry pushes prices as a result of sluggish behavior or the pursuit of oligopoly profits. Quotas therefore distort the market more and stimulate modernization by domestic firms less than tariffs (even if they are set to cause identical divergence between domestic and import prices). Equally important, quotas provide windfall gains to the foreign firms instead of revenues to the importer government, giving the former an advantage over local companies. Finally, quotas that take the form of Voluntary Restraint Agreements (VRAs, self-administered export limitations among foreign producers) are likely to solidify the oligopolistic structure of the external industry and inhibit new entrants to that industry.⁴⁴ For the multiplication and diversification of external suppliers, quotas are bad news and VRAs worse. Similarly, in retaliating against unfair trade practices, prompt and effective countervailing duties to offset foreign dumping (the proper response to targeting by other governments) make good sense, whereas international agreements that provide rents to foreign producers make no sense.

In this context, it becomes clear that American trade policies to meet legitimate national security concerns about the fate of key domestic industries (including machine tools, steel, and semiconductors) have been counterproductive.⁴⁵ In machine tools, instead of focusing tariff relief on those sub-

44. VRAs tend to discriminate against new producers in established exporter countries, since existing firms are likely to get the available quota portions. They place a cap on both existing and new producers in emerging exporter countries, inhibiting the realization of economies of scale. At the same time, however, they may stimulate existing producers to move to sites in new countries, so as to slip in exports from outside the VRA regime. The latter effect is likely to be strong only in industries with small economies of scale (like textiles).

45. Except for machine tools, these cases have not formally involved Section 232 (national security) petitions, which in the past proved ineffective. The Omnibus Trade Bill of 1988

sectors where tight concentration ratios might show a genuine national security threat (e.g., grinders of ceramic and other non-metallic materials), the U.S. government negotiated a VRA in 1986 for the entire industry.⁴⁶ The result for U.S. defense contractors has been higher costs for all machine tools (even standardized models for which production is thoroughly dispersed), longer delivery times, consignment to inferior machines (which cannot hold tight tolerances, for example, or which break down often), and a need to spend substantial sums to rebuild mainstream models for which replacements are no longer available in the United States. While rolling back imports from Japan, West Germany, Switzerland, and Taiwan, the quantitative restrictions simultaneously retarded the expansion of new suppliers in Spain, Italy, Belgium, and Denmark.

Even more pernicious in its impact on the defense industrial base has been U.S. policy toward the steel industry.⁴⁷ While American steel companies have been protected almost continuously since 1968, the price of steel for U.S. users has averaged 25 percent higher than in Japan and 20 percent higher than in West Germany, raising procurement costs by tens of billions of dollars and undermining the competitiveness of American manufacturers when they attempt to sell abroad. The indirect costs have included the movement of American manufacturing companies offshore to take advantage of cheaper steel elsewhere, and the ever-deeper penetration of imports from foreign manufacturers, many of whose industries are not becoming deconcentrated as rapidly as steel. As for the proliferation of steel producers themselves, the latest VRA (1982, renewed in 1989) not only imposed a lid on fifteen existing

strengthened national security procedures, although it is too early to judge its impact. Cf. Edward E. (Ted) Groves, "A Brief History of the 1988 National Security Amendments," *Law and Policy in International Business*, Vol. 20, No. 3 (1989).

46. U.S. International Trade Commission (U.S. ITC), Investigation No. 332-149 under Section 332 of the Tariff Act of 1930, *Competitive Assessment of the U.S. Metalworking Machine Tool Industry* (Washington, D.C.: U.S. ITC Publication 1428, September 1983). Prestowitz, *Trading Places*; Dertouzos, Lester, and Solow, *Made in America: Regaining the Productive Edge*. In addition, the Senate and House passed "Buy-American" legislation mandating that expenditure of Department of Defense funds be restricted to American-made machine tool products. DoD, *The Impact of Buy-American Restrictions Affecting Defense Procurement*, Report to the United States Congress by the Secretary of Defense, July 1989.

47. Robert W. Crandall, *The U.S. Steel Industry in Recurrent Crisis: Policy Options in a Competitive World* (Washington, D.C.: Brookings, 1981); Gary Clyde Hufbauer, Diane T. Berliner, and Kimberly Ann Elliott, *Trade Protection in the United States: 31 Case Studies* (Washington, D.C.: Institute for International Economics, 1986); and The Stern Group, *Rebuilding American Manufacturing in the 1990s: The Case Against Steel VRAs* (Washington, D.C.: February 1989).

suppliers but required new entrants like Canada and Mexico to pledge not to expand output under the umbrella of the resulting high prices.⁴⁸

The self-inflicted damage of the steel case has been compounded, in ways even more important for U.S. defense, in semiconductors.⁴⁹ The concentrated structure of the world's semiconductor industry, with Japanese predominance, has constituted a legitimate source of national security concern. However, instead of imposing a tariff to protect American producers coupled with countervailing duties to offset foreign dumping, the U.S. government was persuaded to negotiate an agreement with Japan to establish a "fair value" floor price under the entire semiconductor market. The Semiconductor Agreement of 1986 took the concept of a floor price to its logical extreme, extending compliance (under MITI supervision) around the globe.

Whether this "goaded MITI into forming a cartel," as Kenneth Flamm of the Brookings Institution has argued, or "only encourage[d] cartel-like behavior by both Japanese and U.S. producers" as Roger Majak of Tektronix has asserted, is indecipherable in the data.⁵⁰ But the existence of the price floor clearly provided a large competitive advantage to foreign electronics companies with their own captive semiconductor fabrication facilities, where costs continued to decline while market prices rose to the "fair value" price and beyond. As a consequence of the Agreement, therefore, American semiconductor users (with the exception of IBM which fabricates its own) found themselves in a greatly disadvantaged position in comparison to integrated rivals from abroad; the penalty from more expensive chips ranged from 5 percent of production costs for a mainframe computer to 50 percent for other high-tech products where miniaturization is important. The result has been an artificial boost for foreign sellers of defense goods (and dual-use components) trying to break into the U.S. market.

48. The steel VRA of 1982/1989 has taken the place of the more desirable option, namely, moving aggressively to impose countervailing duties to offset foreign dumping. Thomas C. Graham, "Should the U.S. Drop Steel Quotas? No: Not With Continued Foreign Dumping," *Christian Science Monitor*, April 24, 1988, p. 18.

49. Dan Okimoto, T. Sugano, and F. Weinstein, *Competitive Edge: The Semiconductor Industry in the U.S. and Japan* (Stanford: Stanford University Press, 1985); and Defense Science Board Task Force, *Report on Semiconductor Dependency* (Washington, D.C.: DoD, February 1987).

50. Quoted in Stuart Auerbach, "U.S. Chip Industry Rivals Wire Together an Alliance," *Washington Post*, August 14, 1988, p. H6. Besides preventing dumping, a second rationale for the Semiconductor Agreement, increasingly emphasized by the Semiconductor Industry Association once the counterproductive nature of the global floor price became evident, was to enhance access to the Japanese market. The Agreement has been notably unsuccessful in achieving this objective.

Overall, data currently available do not permit a detailed evaluation of how serious the concentration of foreign suppliers is. Among all companies (U.S. and foreign) selling equipment and material to the U.S. Department of Defense (DoD), providers of finished systems have undergone a process of reconcentration in the past twenty-five years, with the top four firms supplying approximately 33 percent of the DoD market in 1955 but 54 percent of the DoD market in 1982 (the last year for which data are available).⁵¹ Providers of components and sub-assemblies, however, have become less concentrated, with the top four firms moving from 56 percent of the DoD market in 1957 to 39 percent of the market in 1982. For finished systems, imports represent 14 percent of the DoD market (1986), and for components and subassemblies, 19 percent (1986). While the data do not allow a direct calculation of the concentration of foreign suppliers, one might reasonably infer that foreign suppliers represent a mix of concentration threats and non-concentration non-threats.

In dealing with this mix, future defense industrial strategists will want to avoid trade protectionism when at all possible (given the cost it imposes across the range of defense activities in terms of high cost, low quality, and limited innovation), except in those cases where subsectors of industries crucial to defense are disappearing without evidence of a corresponding dispersion and deconcentration among suppliers in the external market. In such cases, where patience is risky, the kind of trade protection that makes the most sense is a tariff that is visible, is temporary, and stimulates further U.S. modernization and adjustment.⁵² If, for example, a subcategory of specialty metals or machine tools with a particularly tight industrial concentration, say a titanium alloy or high performance gear cutter, were threatened by international competition, a national security tariff for that subcategory but not protection for the entire industry would be appropriate. Similarly if E²PROMs (Electronically Erasable Programmable Read Only Memories, crucial for rapid retargeting of smart weapons) came to be threatened along with

256K DRAMs (standard low density memory chips), the former might be eligible for a national security protective tariff whereas the latter might not, depending upon the respective concentration ratios at the time. If unfair trade practices are involved, a countervailing duty is the kind of retaliation against unfair trade practices that best meets the needs of national defense.⁵³

Voluntary Restraint Agreements and other quantitative restrictions,⁵⁴ in contrast, combine the evils of high cost and low performance with cartelization and impediments to the multiplication and diversification of sources of supply. As a tool for managing the evolution of the defense industrial base, the protectionist measures most popular in the United States today are counterproductive in the extreme. The prompt and reliable imposition of a national security tariff, coupled with the prompt and reliable imposition of countervailing duties, should be the policies of choice for defense industrial strategists.⁵⁵

STRATEGIC TRADE POLICY

These considerations do not, however, exhaust the arguments about using trade protection to try to enhance national security. The new school of strategic trade policy finds promise in combining protection with promotion for select high tech sectors.⁵⁶ Emphasizing imperfect competition as a key

53. How much of an industry should be protected to preserve U.S. capacity along the (concentrated) cutting edge is an empirical question whose answer is almost always more narrow than protecting the entire industry. With regard to unfair trade practices, no area of U.S. trade law is more frustrating, to plaintiffs and defendants alike. The reform of U.S. trade regulations to provide a timely response to foreign subsidies, targeting, and dumping, so as to avoid Voluntary Restraint Agreements, has a national importance that transcends the needs of the defense industrial base.

54. Defense industrial strategists should be particularly wary of the idea of managed trade as espoused by, among others, Henry Kissinger and Cyrus Vance. Setting a specific target for bilateral trade balances not only requires cartelization to be implemented but allows the foreign government to choose which sectors will have privileged access to the U.S. market. Henry Kissinger and Cyrus Vance, "Bipartisan Objectives for Foreign Policy," *Foreign Affairs*, Vol. 65, No. 5 (Summer 1988), pp. 899-922.

55. A national security tariff or, where necessary, countervailing duty can be effectively used without changing the 1988 trade legislation. One should not imagine, however, that a tough approach using these tools would meet with enthusiasm from the affected domestic industries, since profits and stability for them are much more comfortably assured under a Voluntary Restraint regime.

56. James A. Brander and Barbara J. Spencer, "Tariffs and the Extraction of Foreign Monopoly Rents and Potential Entry," *Canadian Journal of Economics*, Vol. 14, No. 3 (August 1981), pp. 371-389; Brander and Spencer, "Export Subsidies and International Market Share Rivalry," *Journal of International Economics*, Vol. 18, No. 1 (February 1985), pp. 83-100; Paul R. Krugman, *Strategic Trade Policy and the New International Economics* (Cambridge: MIT Press, 1986); and Klaus Stegmann, "Policy Rivalry among Industrial States: What Can We Learn From Models of Strategic Trade Policy?" *International Organization*, Vol. 43, No. 1 (Winter 1989), pp. 73-101.

51. Bingaman and McCain, *Deterrence in Decay*.

52. An interesting variation might be a tariff quota, in which imports can enter the home country in amounts greater than allowed by the quota, but only at a higher tariff rate. This would maintain competitive pressures for innovation and adjustment. The quota amount could then be auctioned off to any supplier who did not fall under the four country/four producer rule. This would provide a stimulus to the diversification of suppliers and of supply sites, and shift rents from foreign producers to the home government. See C. Fred Bergsten, Kimberly Ann Elliott, Jeffrey J. Schott, and Wendy E. Takacs, *Auction Quotas and United States Trade Policy* (Washington, D.C.: Institute for International Economics, September 19, 1987).

part of the trade policy debate, the central argument of this school is that, in industries with increasing returns to scale and a substantial potential for cost reduction via learning-by-doing, only a few firms can "fit" profitably in the global marketplace. A deliberate combination of import restriction and export promotion might therefore propel a country's own entrants into a leading position, bolstering their prospects for world predominance while denying the opportunity to rivals. This might eliminate or drastically cut back the problem of foreign control, replacing dependency with supremacy.

Since the first appearance of strategic trade theory, however, questions have been mounting about its utility as a policy tool, even among its originators. First, there is a formidable challenge in deciding exactly which industries meet the structural prerequisites and which do not, not to mention ensuring that political forces do not bias whatever objective criteria for selection are discovered. Wrong choices not only waste resources but create monopolists whose principal impact will be to collect rents from the country's own citizens. Second, the approach carries inherent dangers to other important industries. High tech industries all draw on a common pool of scientists, engineers, managers, and finance capital; until replacements are found (or created), there are disadvantages to emphasizing some uses for these resources at the expense of others. Finally, the strategic trade endeavor will work only if other countries and their firms back off and allow the attempt of a given country to achieve predominance to come to fruition. A retaliatory response spoils the effect, to the detriment of all of the countries involved.

Despite the doubts about its utility, however, enthusiasm for trying out the theory has picked up steam, especially among industrial policy advocates.⁵⁷ It holds out the enticing possibility of creating national advantage in one targeted industry after another. And it has solid (albeit controversial) theoretical underpinning.

The task of evaluating conflicting views about using strategic trade policy is not easy, since the debate has thus far been highly theoretical, with few empirical examples to illustrate actual outcomes. Here is where the lessons of the Nimrod case may prove helpful.⁵⁸ The Nimrod project started with a

strong national team who quite probably could have met the original design specifications within tolerable cost and performance margins in comparison to other producers. But a changing environment required extensions of the technological frontier in multiple areas (fuselage, engines, radar, data integration), which together went beyond the reach of even an initially superior contender. In the end, the autarchic strategy turned out to be both an engineering and a commercial disaster, compared with Boeing's deliberately contrasting effort to build up a multinational team.

The Nimrod case does not refute the idea that national economic supremacy (point "B" in Figure 1) is a highly desirable position for a major state, nor does it demonstrate that the United States can never attain it. But with foreign competitors taking the lead in more than a quarter of the twenty-two technologies most crucial for defense, the prospect of success for an autarchic "strategic trade policy" seems decreasingly likely, even for the United States. At some point the American teams (even in areas in which the United States is currently ahead, such as aerospace, computers, microprocessors, supercomputers, telecommunications, specialty chemicals, and composite materials) would want to reach out to take advantage of superior inputs elsewhere (in integrated optics, microelectronic circuits, biosensors, or gallium arsenide digital filters, for example).⁵⁹

"Reaching out" may be an important tool to ensure access to foreign markets as well as to acquire foreign technology, since a trans-national production strategy builds economic and political constituencies who favor buying the joint product and are willing to oppose those who want to exclude it. Efforts to bottle up target industries as national preserves to gain national

57. In addition to the sources cited in note 26, see Michael Borrus, Laura D'Andrea Tyson, and John Zysman, "Creating Advantage: How Government Policies Shape International Trade in the Semiconductor Industry," in Krugman, *Strategic Trade Policy*; Jacques Gorlin, "A National Technology Strategy: Pick Key Industries and Exploit Them," *New York Times*, February 19, 1989, p. 35; James K. Galbraith, "Industrial Policy: Yes, There Is a Case For It," *Wall Street Journal*, May 18, 1989, p. 27.

58. The Nimrod case constitutes the best test for strategic trade theory since it has the structural

attributes the model calls for, plus an empirical probability of turning out either successfully or not, without the exogenous circumstance of collapsing demand to ruin the experiment. Two of the other three cases most frequently cited in the strategic trade debate, the Concorde supersonic jet and the fast breeder reactor, merely illustrate that governments can guess wrong about future markets when they attempt strategic targeting. The third case, Airbus, in fact illustrates the opposite of what strategic trade theorists use it for; the Airbus success testifies to the fact that a transnational production strategy is vital for keeping markets open. Cf. Barbara Spencer, "What Should Trade Policy Target?" and William H. Branson and Alvin K. Klevorick, "Strategic Behavior and Trade Policy," in Krugman, *Strategic Trade Policy*; Joan Pearce and John Sutton with Roy Batchelor, *Protection and Industrial Policy in Europe* (London: Routledge and Kegan Paul for the Royal Institute of International Affairs, 1986); and Herbert Kitschelt, "Four Theories of Public Policy Making and Fast Breeder Reactor Development," *International Organization*, Vol. 40, No. 1 (Winter 1986), pp. 65-104.

59. DoD, *Critical Technologies Plan*. See also National Academy of Engineering, *Strengthening U.S. Engineering Through International Cooperation: Some Recommendations for Action* (Washington, D.C.: National Academy Press, 1987).

leverage, in contrast, could generate a tit-for-tat retaliatory response, leading to the "Nimrodization" of the world's most dynamic industries. Unilateral trade policies that are designed to consolidate national advantage consciously and explicitly at the expense of one's national rivals are likely to provoke them to a strong reaction, all the more so when the advantage sought is clearly crucial to their national defense. The result would be worse than a stalemate for all participants.⁶⁰

In general, therefore, while "strategic trade policy" remains an interesting theoretical possibility in a world of imperfect competition, the feasibility of implementing it in any given industry over an extended period of time is doubtful, the likelihood of retaliation in the absence of local partners and subcontractors to help prevent it is high, and the implications of failure for the performance of the defense effort are grave. The better alternative is to push hard for parity of access and national treatment, with none of the major industrial powers attempting to use sheltered markets as a lucrative base to subsidize the expansion of their firms abroad.

POLICIES TOWARD FOREIGN INVESTMENT AND FOREIGN ACQUISITION OF U.S. DEFENSE INDUSTRIES

In contemporary literature, foreign direct investment constitutes a "penetration" of the defense industrial base, and acquisition of a U.S. defense company by a foreigner represents a "loss" to the base. From 1981 to 1986 (the last year for which there are disaggregated data), foreign acquisitions of U.S. high technology firms grew from approximately 30 to more than 130 per year.⁶¹

To protect classified information, the Department of Defense has especially restrictive rules for foreign contractors, requiring either the negotiation of a "special security arrangement" (SSA), or the establishment of a nonvoting

60. Brander and Spencer argue that one objective of a strategic trade policy is to induce foreign firms to reduce their R&D levels. If this did not happen, Spencer argues, strategic trade policy could rely on home country intervention to induce the transfer of foreign technology to domestic firms. This is of course likely to provoke retaliatory efforts by other governments to prevent such transnational technology transfer. Spencer, "What Should Trade Policy Target?"

61. Cumulative acquisitions 1981-86 by high-tech sector were: electrical and telecommunications equipment (36 percent); chemicals, pharmaceuticals, and biotechnology (20 percent); computers (16 percent); machine tools (13 percent); precision instruments (11 percent); R&D labs (2 percent); and aerospace (2 percent). Final Report of the Defense Science Board, *The Defense Industrial and Technology Base*, p. 37.

trust for the foreign parent, with the top management and board of directors of the U.S. subsidiary all being U.S. citizens.

Recent American policy, however, has a new thrust, moving beyond measures to regulate the handling of classified materials, toward an effort to keep foreigners from "burrowing into" the American defense industrial base. Federal legislation (the Exon-Florio amendment of 1988) has given the president the authority, on national security grounds, to prevent an American company from falling into foreign hands through merger, acquisition, or takeover. Long quasi-dormant, the U.S. government's screening mechanism, the Committee on Foreign Investment (CFIUS), found itself jolted awake: in the twelve years preceding the Exon-Florio amendment, it reviewed fewer than thirty cases; in the first twelve months after, more than fifty.⁶²

In an era in which the technological lead in industries of vital importance to defense is shared more broadly than in the past, a restrictive approach carries dangers of its own. First, it can have a chilling effect on foreign companies that would otherwise become involved as suppliers to the Defense Department when they take over American businesses, thus depriving the United States of their innovative potential. Second, insofar as foreign firms do want to remain suppliers of defense-related products, a restrictive approach might encourage them to keep those parts of their business at home (or shift and reconsolidate new defense-related activities there), depriving the United States of the potential clout it could exercise over local operations in any confrontation with the home government of the company. For these reasons, some analysts argue, the United States has an interest in expanding foreign direct participation in the defense industrial base.⁶³

How can American policy toward foreign investment and foreign acquisition of U.S. companies reconcile the desire for access to superior technologies, products, and management techniques with the reluctance to open up new channels for foreign control? There are three prototypical circumstances.

First, there is the case where direct foreign investment creates subsidiaries that want to extend their operations into defense-related activities (e.g., research subsidiaries of computer concerns that move into fabrication of dual-use or dedicated military products).⁶⁴ Placing obstacles in the road of such

62. Martin Tolchin, "Agency on Foreign Takeovers Wielding Power," *New York Times*, April 24, 1989.

63. Cf. Edward M. Graham and Paul R. Krugman, *Foreign Direct Investment in the United States* (Washington, D.C.: Institute for International Economics, 1989), chap. 5.

64. The Exon-Florio Amendment does not cover start-up investments.

activities simply means that the products, if useful and needed, will be fabricated by the foreign companies outside the United States and imported, thereby minimizing U.S. control over the conduct of business. The guidelines for this type of case should be to treat the foreign firm like any other (once an appropriate special security arrangement is in place for classified materials), and not hinder the expansion of its operations into the defense area.

Second, there is the case of a prospective foreign acquisition of a U.S. firm, where the foreigner intends to divest itself of all defense-related activities. A 1989 example is the proposal of the Tokuyama Soda Company of Tokyo to buy General Ceramics, Inc., of New Jersey, which has units that produce beryllium materials for use in nuclear weapons.⁶⁵ Both Tokuyama Soda and General Ceramics agreed to sell the military-oriented facilities to other U.S. buyers. The U.S. government should probably be neutral towards this type of transaction, allowing the acquisition to proceed if the parties can reach an agreement, and letting the market sort out the divestiture and reacquisition of the units devoted to defense.⁶⁶ Blocking the acquisition, in effect forcing the U.S. company to stay in the defense business in the face of lucrative offers to sell out, will simply have a negative impact on the decision of American companies to engage themselves fully in defense applications, especially when such applications may constitute a small fraction of their overall commercial operations.

Third is the case of a proposed foreign acquisition of a U.S. firm, where the foreigner intends to continue a business of direct importance to U.S. defense industries. If the business includes classified material, a satisfactory special security arrangement is a prerequisite, but often there is no classified work involved, such as the case of Heuls A.G. of West Germany, which proposed to purchase a unit of Monsanto that fabricates silicon wafers used for computer chips in the semiconductor industry. Here the 4/50 rule would provide a useful screening device. If the company to be acquired were not in an industry in which four firms or four countries supply fifty percent or

more of the market, no inhibitions to the acquisition would be justified.⁶⁷ If the company to be acquired did fall within an industry concentrated in the 4/50 danger zone, in contrast, the Committee on Foreign Investment should block the proposed takeover.⁶⁸

It should be noted that such an approach helps but does not totally protect the United States against the prospect of foreign influence, foreign manipulation, and foreign control via the process of foreign investment and foreign acquisition of American companies. To plug the remaining holes, the country will have to conclude an international agreement on extraterritoriality discussed below.

A New Framework for Foreign Dependence and National Security

In conclusion, the new generation of defense industrial strategists must refocus the debate about policy options for the United States in fundamental ways, examining:

1. Not whether globalization poses a real threat or not, but exactly what kind of a threat it is;
2. Not whether the neo-mercantilistic preferences for national companies and national soil contradict the liberal economic search for efficiency, but how these variables can be controlled to serve the goals of national autonomy and domestic efficiency at the same time;
3. Not whether a policy of public support for cutting edge technologies implies an ideological switch from market allocation to government intervention, but how to structure such a policy to direct available funds to where the national interest most needs them;
4. Not whether trade protection is a legitimate tool to use in supporting the defense industrial base, but how it can be designed to provide timely non-counterproductive protection when national security interests are in fact jeopardized;

65. Martin Tolchin, "U.S. Stops Japanese Acquisition," *New York Times*, April 18, 1989.

66. Under Exon-Florio, "national security" is intended to be interpreted broadly, but no specific test is given for determining whether "there is credible evidence that the foreign entity exercising control may take action that threatens to impair the national security." In practice this has led to a case-by-case approach following the principle, according to Stephen Canner, staff chairman of CFIUS, that "I cannot define national security, but I know it when I see it." Department of the Treasury, Remarks of Stephen J. Canner, "U.S. Investment Policy and Exon-Florio," July 25, 1989.

67. It should be noted that the 4/50 concentration measure applies to the world arms-length market, not to the share of the U.S. market supplied by the firm to be acquired from a site on U.S. soil, as argued in the Heuls case.

68. In cases involving a faltering American company, the company would be able to seek a national security tariff as proposed earlier. This should bolster its own commercial prospects as well as make it a more attractive candidate for acquisition by an American suitor. A merger or acquisition among smaller firms in a concentrated industry might be permissible if it had the result of diluting the power of the four leaders.

5. Not whether concern about efficiency should soften the use of retaliation against unfair trade practices by America's trading partners, but how to make such retaliation prompt, effective, and consonant with the goal of preventing foreign control over the U.S. economy;
6. Not whether foreign investment in and foreign acquisitions of U.S. defense contractors should be halted or promoted, but how the resources of foreigners can be incorporated into the U.S. defense effort without compromising national sovereignty;
7. Not further rehearsal of the grand debates about whether liberal economics can provide adequate protection against encroaching foreign domination, but practical testing and possible refinement of the 4/50 rule to determine what is necessary to prevent collusion by foreign political or economic actors, as well as refinement of how precise industry specification would have to become.

Addressing these questions will shift the debate about protecting national security from the *extent* of foreign dependence to the *concentration* of foreign dependence, and from concern about *ownership* to concern about *control*. Only then will it be possible to develop strategies to reduce the potential for foreign manipulation to a minimum, while maintaining maximum access to the growing global pool of technological and management skills.

A first priority must be the establishment of a well-structured surveillance system and early warning network. It is unacceptable for a great power to discover, as the U.S. Defense Science Board did, that "neither DoD nor industry has the means of measuring the scope of [foreign] dependence or of identifying the systems and components which are affected."⁶⁹ A monitoring exercise focusing on the 4/50 rule could easily avoid the criticisms advanced against excessive disclosure of proprietary information.

Still, despite the surveillance effort and the 4/50 test, there will always be, in an era of globalization, an irreducible minimum threat of foreign control and foreign manipulation. This arises when a foreign company operating out of its home country (and refusing to leave to undertake R&D or production elsewhere) maintains itself as virtually a sole source supplier of a critical technology or product, or when a foreign company moves some portion of its R&D and production facilities to the host country, but stays within the

tight circle of four or fewer firms supplying at least fifty percent of the international arms-length market, thus preserving itself as a channel for political manipulation by its home government.

To cope with these two situations, there is no unilateral security solution except to maintain a stockpile, or production facilities for a less efficient industrial substitute, in the United States. There is, however, an alternative cooperative approach, which is to negotiate an international convention on extra-territoriality, backed by a dispute settlement mechanism to handle controversies. It could begin with an agreement on what kinds of extraterritorial instructions were permissible and under what conditions they were allowed, including a requirement for pre-notification (similar to U.S. restraints on the re-export of military equipment incorporating U.S. technology) and a prohibition on retroactive *diktats* of the Soviet gas pipeline variety. The Europeans did not have the comfort of negotiating such a code in 1984. Perhaps now, as the United States undergoes a growing exposure to such threats, the opportunity to negotiate a code to handle the common problem of extra-territorial mandates will emerge.

Ultimately the cooperative approach might lead toward an absolute prohibition on all extraterritorial restraints, although the nations involved, including the United States, might decide that this was neither desirable nor feasible. Like other solemn compacts, a multilateral agreement limiting extraterritorial *diktats* will have to be made credible by some array of sanctions.

U.S. defense industrial strategists may be aided in moving in a multilateral direction by the evolution of international corporations toward becoming more a-national actors themselves. When a Fortune 500 company declares that "the United States does not have an automatic call on our resources. There is no mindset that puts this country first,"⁷⁰ Americans consider it front page news today just as the British or French did during the oil embargo. Eventually multinational firms may, for reasons of loyalty to corporate self-interest rather than to country of origin, resist being the channel for external meddling that the neo-mercantilistic vision makes them out to be. Further progress in this direction, paradoxically, will require a dedicated effort to promote the interpenetration of the defense industrial bases of all the major allied powers, an explicit transformation of rival economic nationalism into a new era of managed interdependence.

69. Defense Science Board, *The Defense Industrial and Technology Base, "Findings and Conclusions,"* p. 51.

70. Louis Uchitelle, "U.S. Businesses Loosen Link to Mother Country," *New York Times*, May 21, 1989, p. 1.